

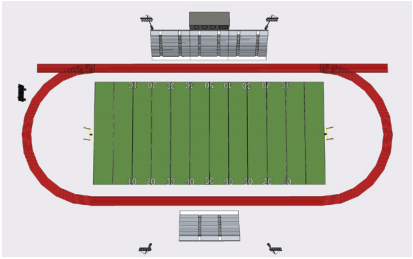
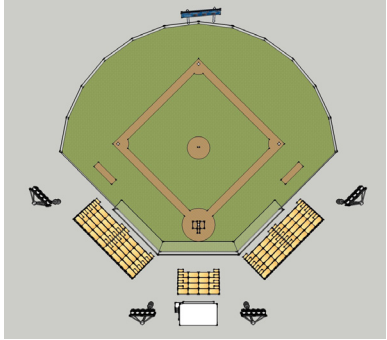
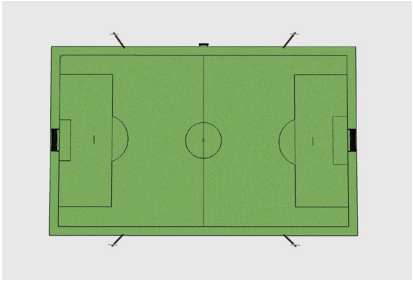
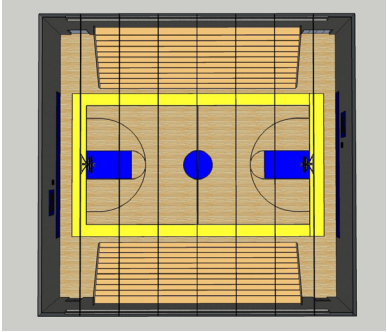
SPORTS SOUND

Loudspeaker System
Design Reference Guide

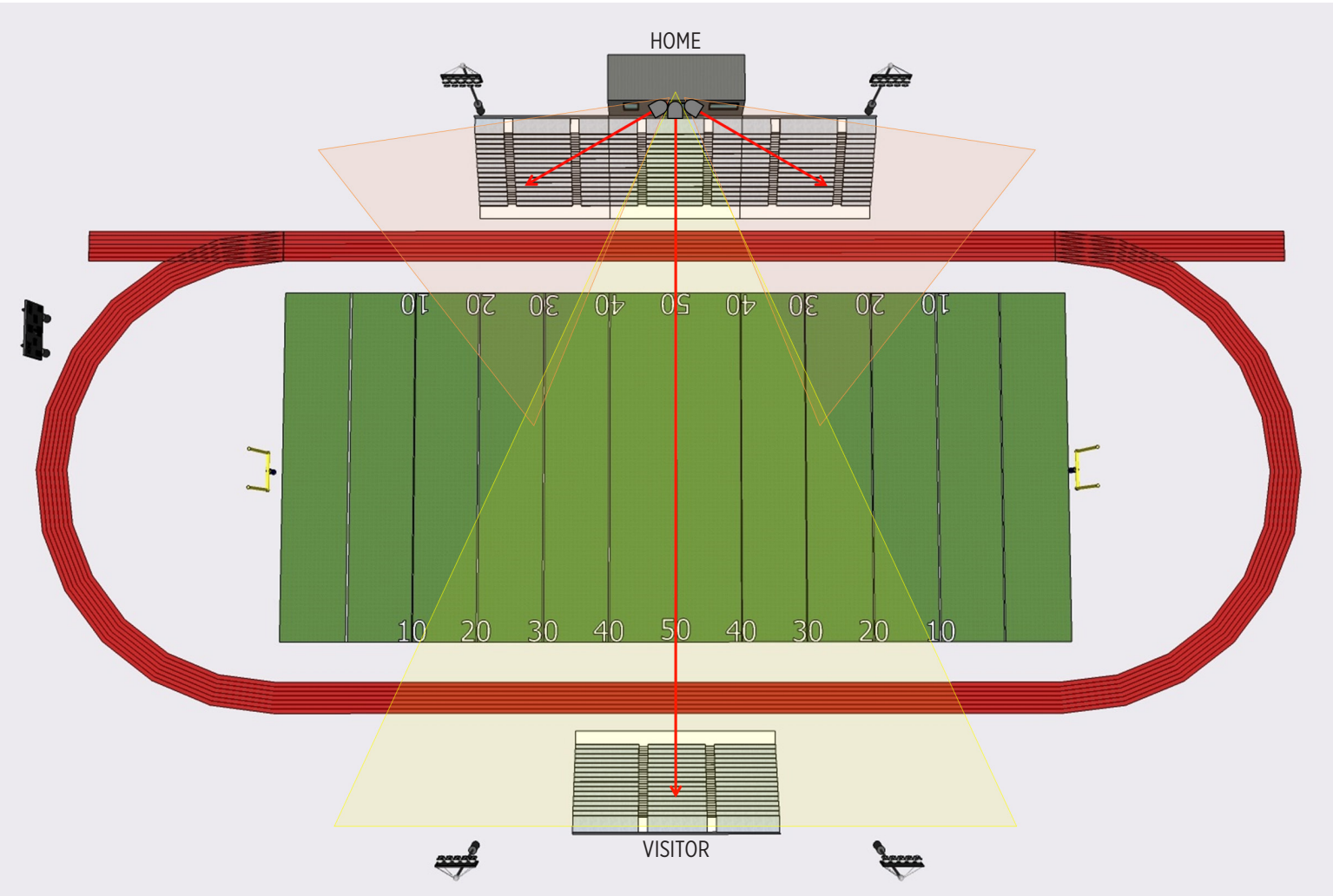
Model	Description	Feet																		Meters	
		30	40	50	60	70	80	90	100	150	160	170	180	190	200	210	220	230	240	250	300+
R.15-3696	3-way, Triaxial; LF: 1 x 6", MF: 2 x 2.35", HF: 1 x 1"	52' / 16m																			
R.15COAX	2-way, Coaxial; LF: 1 x 6", HF: 1 x 1"	32' / 10m																			
R.35COAX*	2-way, Coaxial; LF: 1 x 10", HF: 1 x 1.25"	52' / 16m																			
R.25-94Z	2-way, LF: 1 x 8", HF: 1 x 1"	49' / 15m																			
R.35-3896*	3-way; LF: 1 x 8", MF: 2 x 2.35", HF: 1 x 1"	83' / 25m																			
R.5COAX66/99**	2-way, LF: 1 x 12", HF: 1 x 1"	60' / 18m																			
R.5-66/94/99Z**	2-way, LF: 1 x 12", HF: 1 x 1"	90' / 27m																			
R1-64/66/94**	2-way, LF: 1 x 12", HF: 1 x 1"	148' / 45m																			
R.5HP	3-way; LF: 1 x 12", MF: 1 x 2", HF: 1 x 1"	150' / 46m																			
R.5-66/96MAX	2-way; LF: 1 x 12", HF: 1 x 1.4"	150' / 46m																			
R2-64/66/94MAX	3-way; LF: 2 x 12", MF: 1 x 2", HF: 1 x 1.4"	205' / 61m																			
R2-52Z	3-way; LF: 2 x 12", MF: 2 x 2", HF: 1 x 1"	205' / 61m																			
R2-52MAX	3-way; LF: 2 x 12", MF: 2 x 2", HF: 1 x 1"	252' / 77m																			
R2-77/94/694/474**	3-way; LF: 2 x 12", MF: 1 x 2", HF: 1 x 1"	157' / 48m																			
RMG-200A	1-way; MF: 1 x 2"	240' / 73m																			
R.5-V2200	1-way; MF: 2 x 2"	315' / 96m																			
RSH-462	1-way; MF: 4 x 2"	715' / 218m																			
LLVH-906/AS single cabinet array	3-way, LF: 4 x 12", MF: 3 x 2", HF: 4 x 1.5"	368' / 112m																			
LVH-906/AP dual cabinet array	3-way, LF: 6 x 12", MF: 6 x 2", HF: 8 x 1.5"	518' / 158m																			
IV6 six cabinet typical array	2-way, LF: 6 x 12", HF 12 x 1.7"	335' / 102m																			
IV6 twelve cabinet typical array	2-way, LF: 12 x 12", HF 24 x 1.7"	480' / 146m																			

96 dB SPL with no atmospheric effects
* Voicing switch in Music position
** Average Max SPL considered or Max SPL of the lowest output device

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Football Field 'Press Box'



Installation Description:

- The loudspeakers are mounted on the roof of a press box, preferably at least 16 feet above the highest row of seating.
- The bleachers are assumed to be 20 feet tall at the back row.
- An array of two to four loudspeakers to address the home seating, plus an R2-52Z or R2-52MAX in the center to provide crossfield coverage.

Option A:

- One (1) R2-52MAX (visitor coverage)
- Three (3) R.5-96MAX (home coverage)
- High SPL and best musicality. Addresses larger bleacher areas while projecting uniformly over farther distances.
- Two (2) Voltera D 4800.4

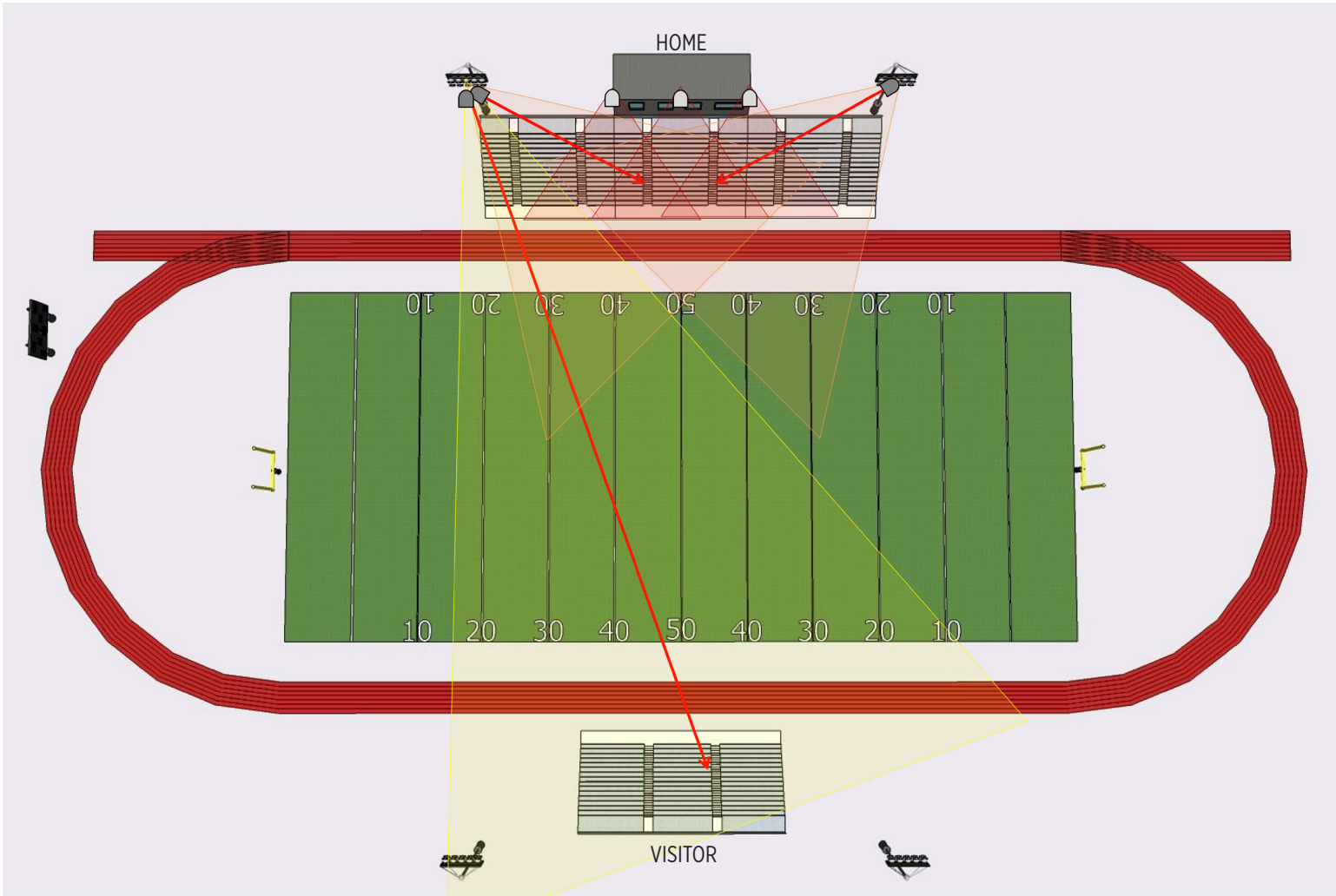
Option B:

- One (1) R2-52Z (visitor coverage)
- Two (2) R.5-94Z (home coverage)
- Moderate SPL for use in venues with shorter bleachers (i.e., the length of the bleachers does not exceed the 30-30 yard line).
- One (1) Voltera D 2400.4

Option C:

- One (1) R2-52Z (visitor coverage)
- Two (2) R2-94Z (home coverage)
- Two (2) R.5-94Z (center of home)
- Very articulate three-way performance and enhanced LF to the home seating section, while providing more even coverage to wide sections of the home stands.
- One (1) Voltera D 4800.4

Football Field 'Lighting Poles'



Installation Description:

- The loudspeakers are pole mounted at least 25 feet above the back row.
- The bleachers are assumed to be 20 feet tall.
- Because the loudspeakers are mounted at a higher point, this system provides more even home seating coverage than the Football Field 'Press Box' design.
- A single R2-52Z or R2-52MAX provides crossfield coverage.
- Additional matching compact loudspeakers on the press box (Extra Coverage- red triangles) will help reduce artificial echoes. This can be added to either Option A or B.

Option A:

- One (1) R2-52MAX (visitor coverage)
- Two (2) R.5-96MAX (home coverage)
- Higher SPL and enhanced musicality for venues where the light poles are up to 240 feet apart.
- One (1) Voltera 4800.4

Option B:

- One (1) R2-52Z (visitor coverage)
- Two (2) R.5-94Z (home coverage)
- Moderate SPL for use in venues with shorter bleachers and light poles up to 180 feet apart.
- One (1) Voltera D 2400.4

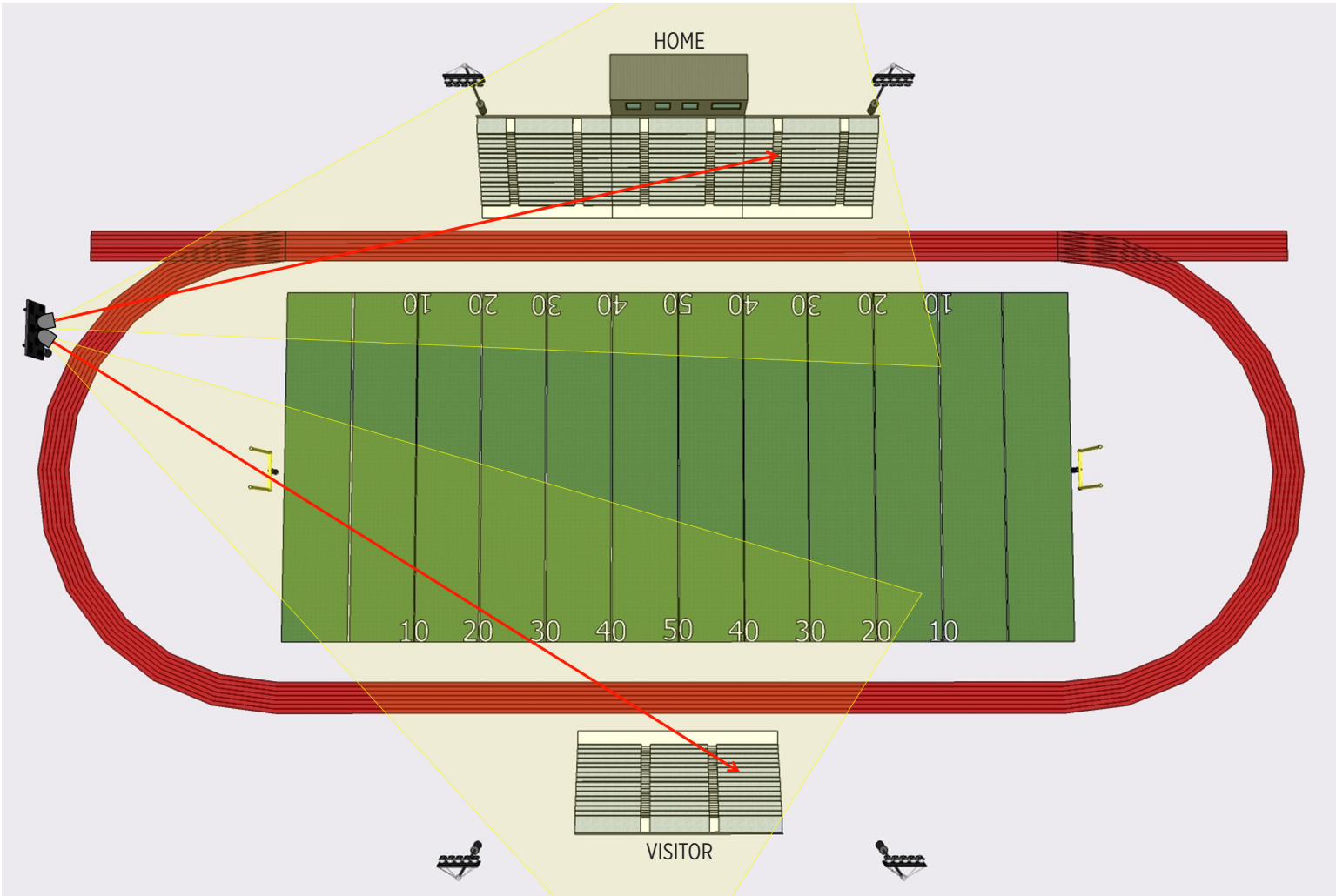
Extra Coverage:

- Three or Four (3-4) R.35-3896 (additional home stands coverage)
- Additional signal-delayed coverage of the home stands helps reduce artificial echoes.
- One (1) Voltera D 1200.4

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Football Field 'Scoreboard'



Installation Description:

- R2-52Z, R2-52MAX or LVH-906WR/AP loudspeakers are mounted to the scoreboard 25 feet above the ground.
- The bleachers are assumed to be 20 feet tall at the back row.
- Atmospheric effects such as wind, diffraction, and excess high frequency attenuation are more likely to be noticed in this design.
- If the length of the home or visitor bleachers exceeds the 20-20 yard line, additional R2-52Z loudspeakers should strongly be considered for one or both sides.

Option A:

- Two (2) R2-52MAX
- Best coverage for shorter bleacher sections from a scoreboard location.
- One (1) Voltera D 4800.4

Option B:

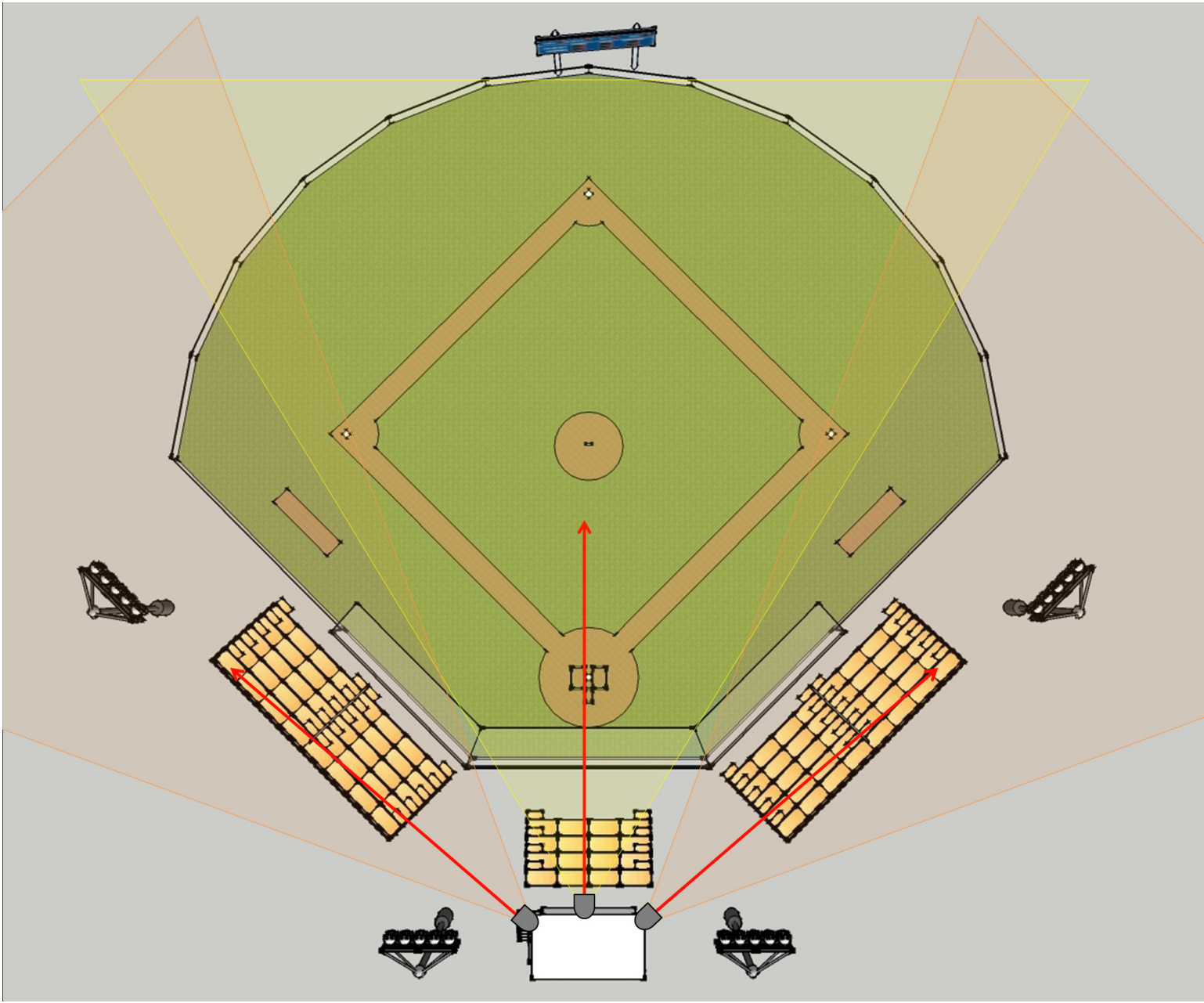
- Two (2) R2-52Z
- Good coverage for shorter bleacher sections from a scoreboard location.
- One (1) Voltera D 2400.2M

Option C:

- Two (2) LVH-906WR/AP
- LVH-906WR/AP provides enhanced SPL at long distances or covers longer bleachers.
- Four (4) ALC-404D
- Four (4) ALC-1604D
- Optional IS8-218 subwoofers for full low frequency support.
- One (1) ALC 3202D per sub

* Amplifier choice maximizes SPL for scoreboard application

Baseball Field 'Press Box'



Installation Description:

- Three (3) loudspeakers mounted on the top of an 18-foot tall press box.

Option A:

- Three (3) R.15-3696
- Good SPL to the infield and the seating, with good speech articulation.
- One (1) Voltera D 1200.4

Option B:

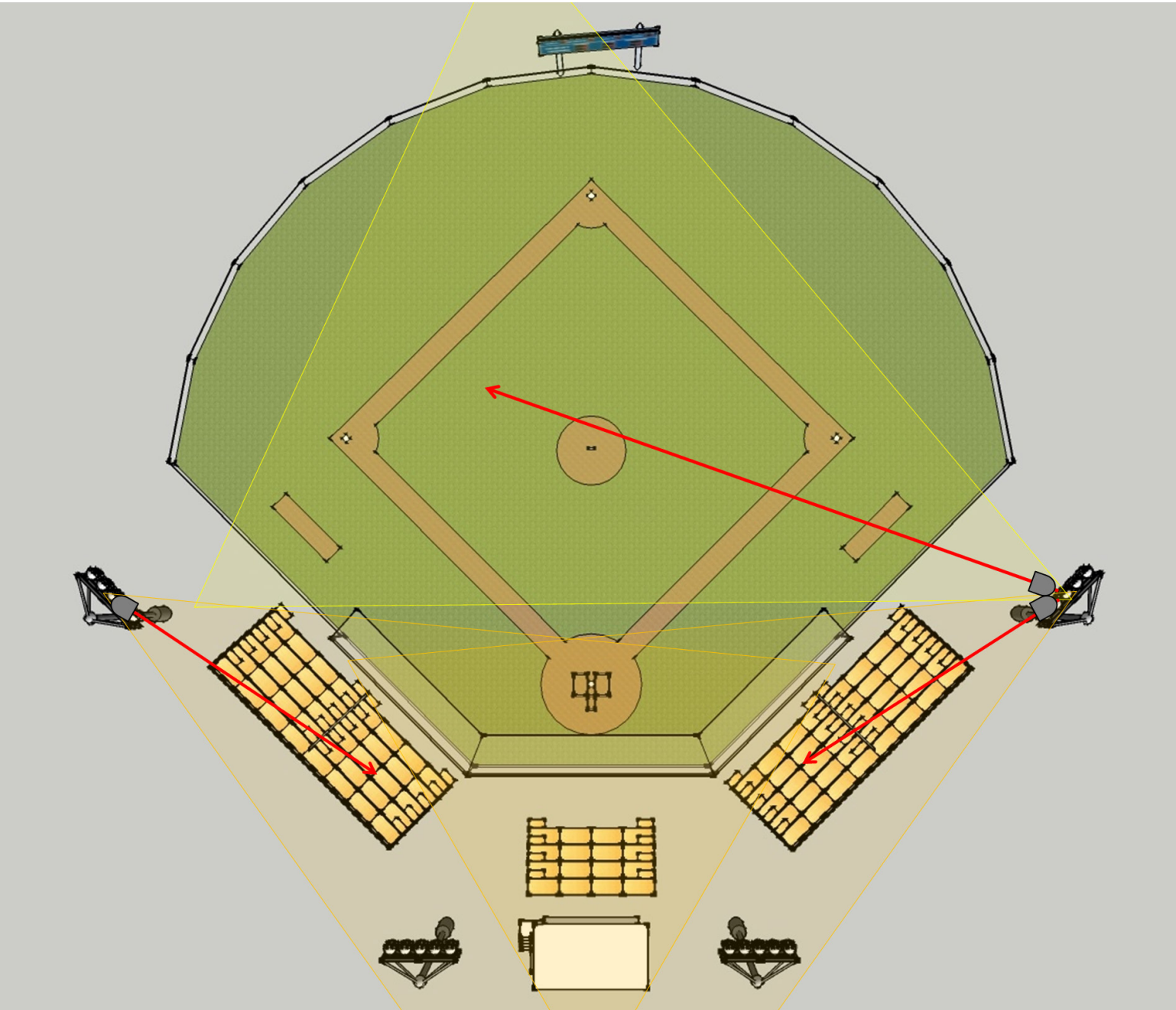
- Three (3) R.5-94Z
- Enhanced SPL and pattern control with better bass extension. Coverage extends up to 160 feet.
- One (1) Voltera D 2400.4

Option C:

- Three (3) R.5-96MAX
- All of the benefits of Options A and B with greater musicality, higher SPL and the ability to address the entire field.
- One (1) Voltera D 4800.4

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Baseball Field 'Lighting Poles'



Installation Description:

- Three (3) loudspeakers pole mounted at a height of 30 feet, and up to 90 feet away from the press box.
- Additional matching compact loudspeakers on the press box (*not shown*) will help reduce artificial echoes.

Option A:

- Three (3) R.35-3896
- Good SPL to the infield and the seating, with good speech articulation.
- One (1) Voltera D 2400.4

Option B:

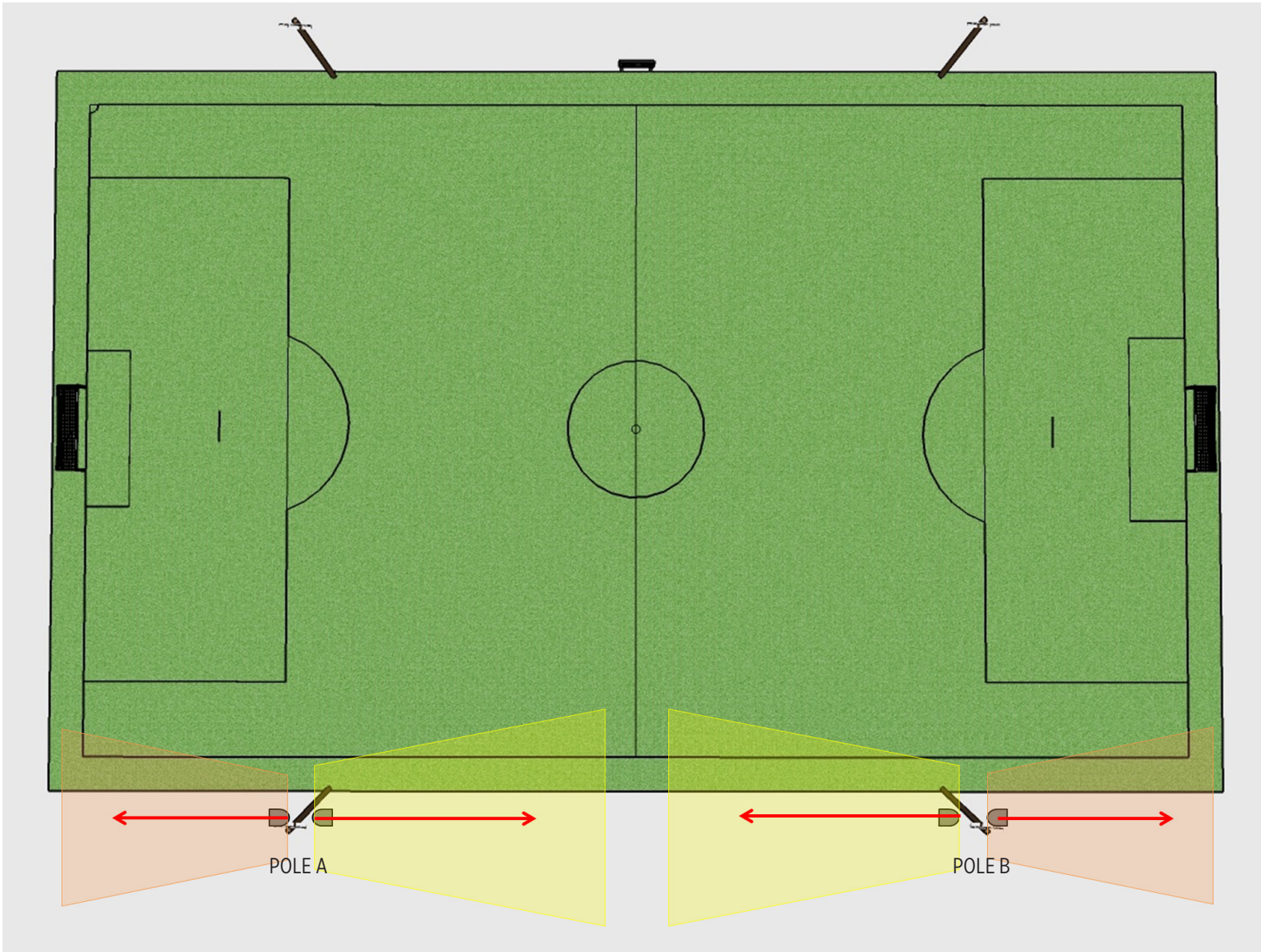
- Three (3) R.5-94Z
- Enhanced SPL and pattern control with better bass extension.
- One (1) Voltera D 2400.4

Option C:

- Three (3) R.5-96MAX
- All of the benefits of Options A and B with greater musicality and higher SPL.
- One (1) Voltera D 4800.4

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Soccer Field 'Pole Mount - Sideline Coverage'



Installation Description:

- The loudspeakers are pole mounted 50 feet above the ground on light poles about 180 feet apart.
- Each loudspeaker aims down sharply to focus on an individual zone, minimizing coverage overlap.
- Seating may be on the ground or small bleachers.
- Alternative Coverage (two to three (2-3) loudspeakers - not shown): If mounting heights must be low and not aimed as sharply down, use only one (1) signal-delayed loudspeaker on "Pole B" aimed away from "Pole A". Or, use a larger model on "Pole A" to address the full "Pole B" zone (no loudspeakers on "Pole B").

Option A:

- Four (4) R.15-3696
- Good voice articulation and good musicality.
- One (1) Voltera D 1200.4

Option B:

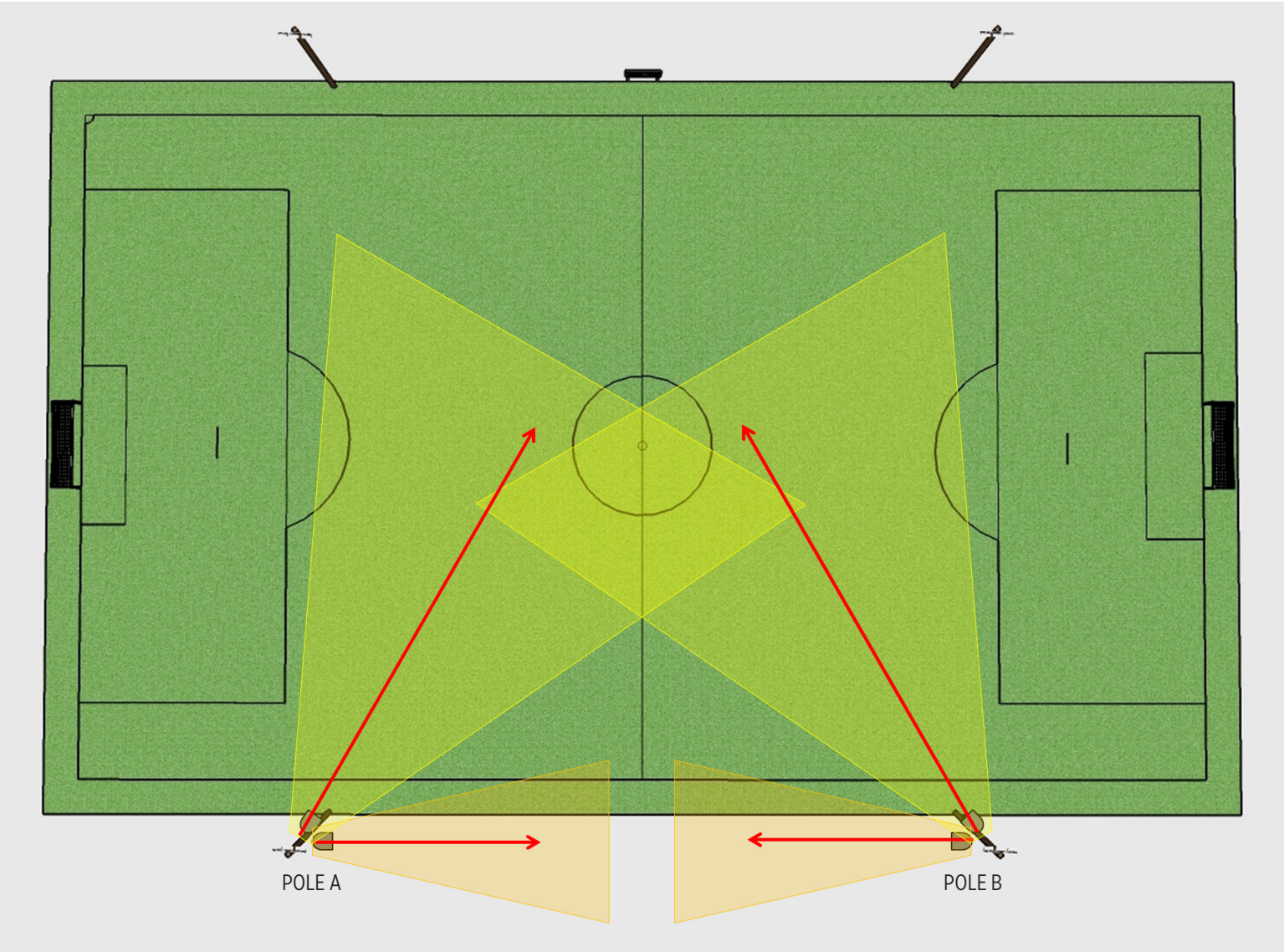
- Four (4) R.35-3896
- Great musicality and excellent voice articulation.
- One (1) Voltera D 2400.4

Option C:

- Four (4) R.5-66Z
- Very good musicality, enhanced low frequency extension and excellent voice articulation.
- One (1) Voltera D 2400.4

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Soccer Field 'Pole Mount - Sideline and Field'



Installation Description:

- The loudspeakers are pole mounted at least 30 feet above the ground on light poles about 180 feet apart.
- Seating may be on the ground between the poles or on small bleachers.
- Higher mounting points are preferred to minimize the effects of artificial echoes, ensuring good intelligibility.
- Another option is using only one loudspeaker array position to cover the sideline area (as explained on page 9) to consolidate the loudspeakers on one pole.

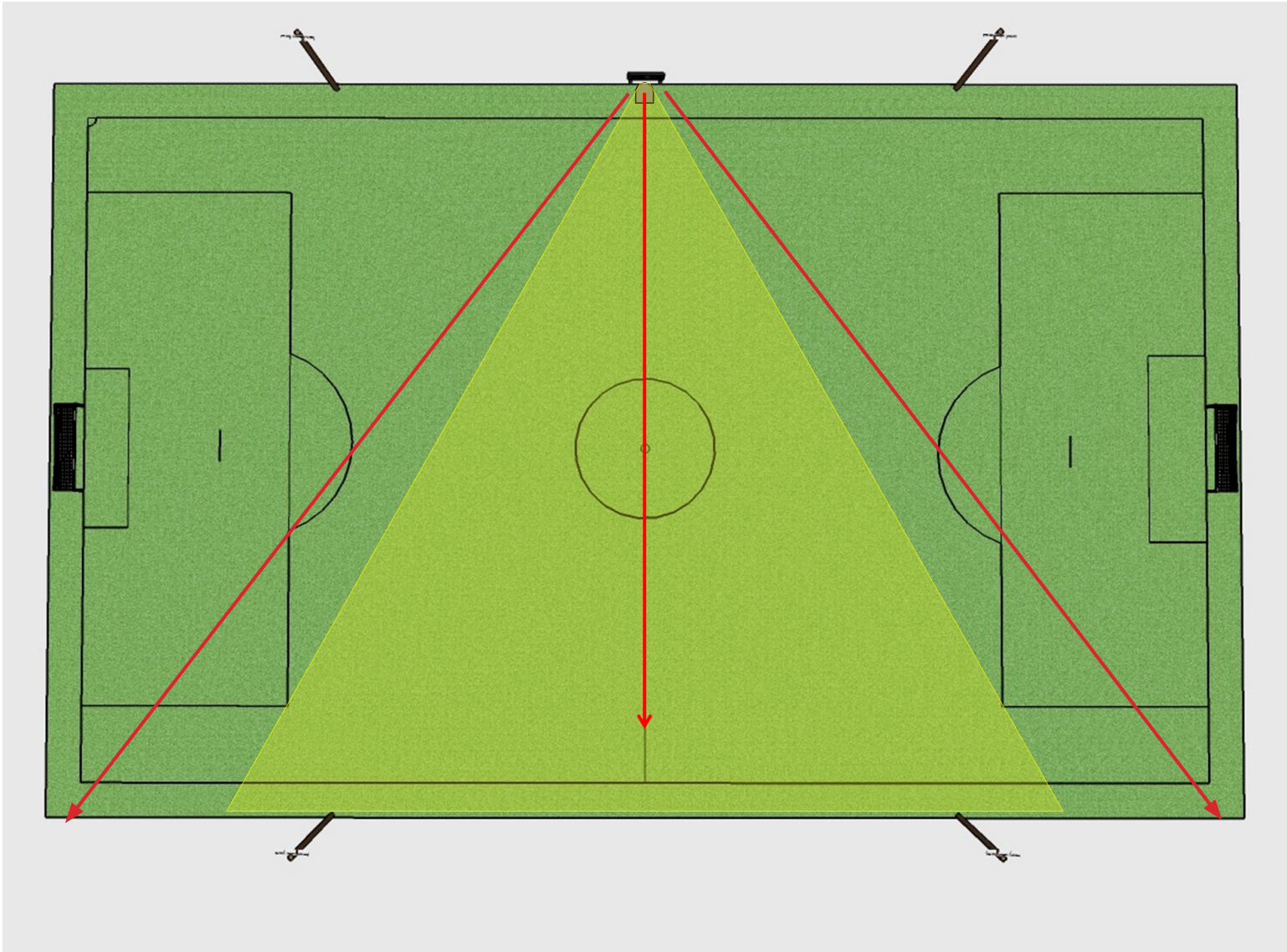
Option A:

- Two (2) R.15-3696 (sideline coverage)
- Two (2) R.35-3896 (field coverage)
- Great musicality and excellent voice articulation for the seating area and the middle of the field.
- One (1) Voltera D 2400.4

Option B:

- Two (2) R.5-66Z (sideline coverage)
- Two (2) R.5-94Z (field coverage)
- Very good musicality, enhanced low frequency extension and excellent voice articulation for the seating area and the middle of the field.
- One (1) Voltera D 2400.4

Soccer Field 'Scoreboard'



Installation Description:

- Single or dual R2-52Z or R2-52MAX loudspeakers are mounted on the scoreboard to cover the middle of the field and the far sideline.

Option A:

- One (1) R2-52Z (single cross-field red arrow; light green color coverage)
- Great coverage for the viewing side and great speech intelligibility. Careful consideration should be given to the amplifier-loudspeaker wire gauge.
- One (1) Voltera D 1200.2M

Option B:

- Two (2) R2-52Z (two yellow arrows from the scoreboard to opposite corners of the field)
- Expanded coverage providing a wider listening area along the entire sideline.
- One (1) Voltera D 2400.2M

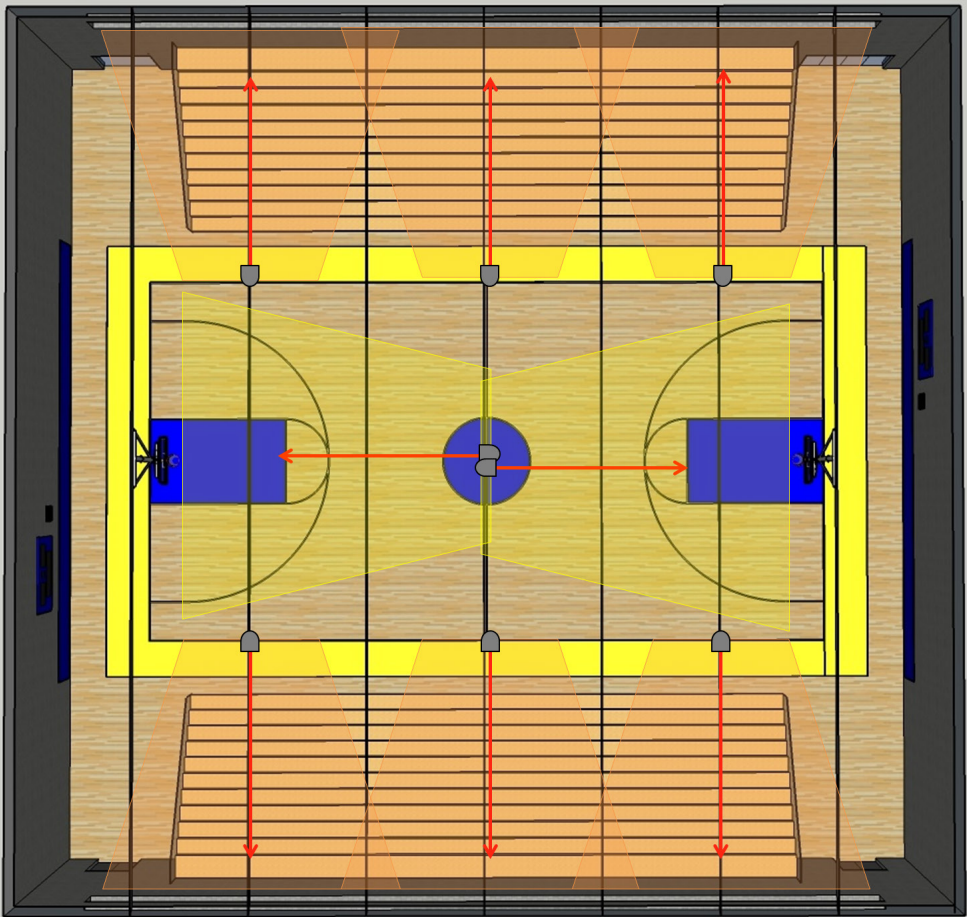
Upgrade Option:

- One (1) R2-52MAX or
- Two (2) R2-52MAX
- Substitute R2-52MAX models in either Option A or B to enhance musicality and intelligibility.
- One (1) Voltera D 4800.2M for one (1) R2-52MAX or one (1) each of Voltera 4800.2M and Voltera D 2400.2M for two (2) R2-52MAX*

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Basketball Court 'General Coverage'



Installation Description:

- A typical 120-foot by 100-foot gymnasium with a 28-foot height to the low steel (bottom of trusses).
- The bleachers are up to 14 feet tall.
- The bleacher loudspeakers are mounted about 20 feet in front of the first row.
- Bleachers longer than 70 feet can require four (4) or more loudspeakers per side.
- The court loudspeakers provide general coverage to the court and floor seating for sporting events.

Option A:

- Six (6) R.5-94Z (bleacher coverage)
- Two (2) R.5-99Z (center court)
- Good pattern control (for intelligibility) and moderate SPL in non-acoustically treated spaces.
- One (1) Voltera D 4800.4

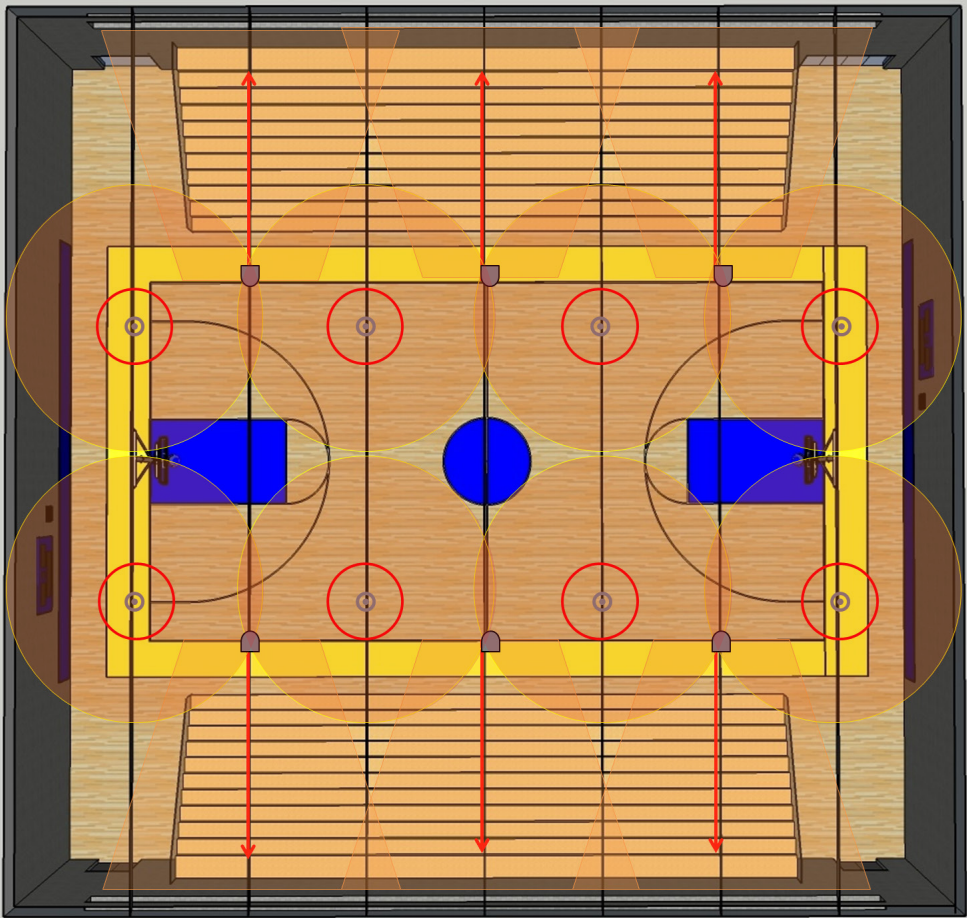
Option B:

- Six (6) R.35-3896 (bleacher coverage)
- Two (2) R.35-3896 (center court)
- Less low frequency extension, but excellent voice clarity with moderate SPL.
- One (1) Voltera D 4800.4

Option C:

- Six (6) R.5-96MAX (bleacher coverage)
- Two (2) R.5-99Z (center court)
- Increased musicality, high SPL, and great pattern control. Subwoofers are often added to this system configuration.
- One (1) Voltera D 4800.4

Basketball Court 'Enhanced Court Coverage'



Installation Description:

- A typical 120-foot by 100-foot gymnasium with a 28-foot height to the low steel (bottom of trusses).
- The bleachers are up to 14 feet tall.
- The bleacher loudspeakers are mounted about 20 feet in front of the first row.
- Bleachers longer than 70 feet can require four (4) or more loudspeakers per side.
- The court loudspeakers provide enhanced coverage to the court for higher speech intelligibility and allow more zone control to accommodate multi-purpose events.

Option A:

- Six (6) R.5-94Z (bleacher coverage)
- Eight (8) R.25-94Z (court coverage)
- Good pattern control and moderate SPL in non-acoustically treated spaces for the bleachers, court and floor seating.
- Two (2) Voltera 2400.4

Option B:

- Six (6) R.35-3896 (bleacher coverage)
- Eight (8) R.35COAX (court coverage)
- Less low frequency extension, but excellent voice clarity with moderate SPL for all areas.
- Two (2) Voltera D 2400.4

Option C:

- Six (6) R.5-96MAX (bleacher coverage)
- Eight (8) R.5-99Z (court coverage)
- Increased musicality, high SPL, and great pattern control across all listening areas.
- Two (2) Voltera D 4800.4

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

* Amplified Loudspeaker Controllers- minimum recommended for low impedance operation with channels maximized.

Product Specifications

For loudspeakers referenced in this guide

R.15-3696		Transducers: LF 1 x 6", MF 2 x 2.35", 1 x 1" exit compression driver Operating Range: 140 Hz to 19.5 kHz Sensitivity (1W/1m): 100 dB Power Handling: 100 W Cont. @ 4 ohm or 70/100V Autoformer Continuous Max Output: 120 dB (132 dB Peak) Nominal Beamwidth (H x V): 100° x 80° Dimensions (H x W x D): 9.25" x 9.25" x 14.00" (235 x 235 x 356 mm)
R.25-94Z (R.25-94TZ)		Transducers: LF - 1 x 8"; HF - 1 x 0.75" exit compression driver Operating Range: 100 Hz - 16 kHz Sensitivity (1W/1m): 97 dB (96 dB) Power Handling: 200W continuous @ 8 ohms (Various) Continuous Max Output: 120 dB (126 dB Peak) Nominal Beamwidth (H x V): 90° x 40° Dimensions (H x W x D): 11.3 x 11.3 x 13.3 in. (287 x 287 x 338 mm)
R.35COAX		Transducers: LF - 1 x 10"; coaxial HF - 1 x 1.25" exit compression driver Operating Range: 70 Hz - 16 kHz Sensitivity (1W/1m): 97 dB Power Handling: 200W continuous @ 8 ohms, or 70V/100V Autoformer Continuous Max Output: 122 dB (128 dB Peak) Nominal Beamwidth (H x V): 90° x 90° (conical) Dimensions (H x W x D): 11 x 13 x 13.5 in. (279 x 330 x 343 mm)
R.35-3896		Transducers: LF - 1 x 8"; coaxial MF - 2 x 2.35" and HF - 1 x 1" exit comp. driver Operating Range: 80 Hz - 16 kHz Sensitivity (1W/1m): 100 dB Power Handling: 400W continuous @ 8 ohms, or 70V/100V Autoformer Continuous Max Output: 126 dB (132 dB Peak) Nominal Beamwidth (H x V): 90° x 60° Dimensions (H x W x D): 11 x 13 x 13.5 in. (279 x 330 x 343 mm)
R.5-66Z (R.5-66TZ)		Transducers: LF - 1 x 12"; HF - 1 x 1" exit compression driver Operating Range: 85 Hz - 16 kHz Sensitivity (1W/1m): 102 dB - 103 dB (101 dB - 102 dB) Power Handling: 200W continuous @ 8 ohms (Various) Continuous Max Output: 126 dB (132 dB Peak) Nominal Beamwidth (H x V): -66Z (60° x 60°), -94Z (90° x 40°), -99Z (90° x 90°) Dimensions (H x W x D): 16 x 16 x 16 in. (406 x 406 x 406 mm)
R.5-94Z (R.5-94TZ)		
R.5-99Z (R.5-99TZ)		
R.5-96MAX		Transducers: LF - 1 x 12"; coaxial HF - 1 x 1.4" exit compression driver Operating Range: 80 Hz - 20 kHz Sensitivity (1W/1m): 103 dB Power Handling: 600W continuous @ 8 ohms Continuous Max Output: 130 dB (136 dB Peak) Nominal Beamwidth (H x V): 90° x 60° (Additional horn patterns available) Dimensions (H x W x D): 16.0 x 16.0 x 16.2 in. (406 x 406 x 411 mm)
R2-94Z		Transducers: LF - 2 x 12"; MF - 1 x 2" exit M200 driver; HF - 1 x 1" exit comp. driver Operating Range: 70 Hz - 16 kHz Sensitivity (1W/1m): 105 dB Power Handling: 400W continuous @ 4 ohms Continuous Max Output: 131 dB (137 dB Peak) Nominal Beamwidth (H x V): 90° x 40° (Additional horn patterns available) Dimensions (H x W x D): 24.75 x 24.75 x 29 in. (629 x 629 x 737 mm)
R2-52Z		Transducers: LF - 2 x 12"; MF - 2 x 2" exit M200 driver; HF - 1 x 1" exit comp. driver Operating Range: 70 Hz - 16 kHz Sensitivity (1W/1m): 107 dB Power Handling: 400W continuous @ 4 ohms Continuous Max Output: 133 dB (139 dB Peak) Nominal Beamwidth (H x V): 50° x 20° Dimensions (H x W x D): 24.75 x 24.75 x 29 in. (629 x 629 x 737 mm)
R2-52MAX		Transducers: LF - 2 x 12"; MF - 2 x 2" exit M200HP driver; HF - 1 x 1" exit comp. driver Operating Range: 71 Hz - 19.5 kHz Sensitivity (1W/1m): LF: 102 dB, HF/MF: 110 dB Power Handling: LF: 1200W cont. @ 8 ohms, HF/MF: 350W cont. @ 8 ohms Continuous Max Output: 135 dB (141 dB Peak) Nominal Beamwidth (H x V): 50° x 20° Dimensions (H x W x D): 24.75 x 24.75 x 29 in. (629 x 629 x 737 mm)
I SERIES POINT SOURCE		Fixed-installation point source family with two performance tiers—600 and 800 level—that allow every loudspeaker in a system to be precisely matched to its acoustic role, producing consistent, cohesive coverage.
I SERIES AND V SERIES SUBWOOFERS		High-performance subwoofers that integrate with I Series and V Series point source loudspeaker installations in large-format applications, such as open-air stadiums.

Full specifications for these, and other models, are available at [biamp.com](#). Loudspeaker data files are available for EASE and EASE Focus acoustic modeling software to facilitate optimum system design. (EASE and EASE Focus are products of AFMG Technologies GmbH.)

Technical Considerations

Biamp Voltera D and D M Amplified Loudspeaker Controllers

Ideal for sports venues, Biamp Voltera D and D M amplified loudspeaker controllers (ALCs) combine high-efficiency amplification, onboard loudspeaker processing, flexible networked audio, and advanced system tuning in a single compact platform. Voltera D models provide powerful, software-configurable loudspeaker control for systems of nearly any size, while Voltera D M models add fully programmable, TesiraFORTE-class DSP to support more complex audio processing and distribution requirements without adding a separate DSP chassis.

Available across a range of power levels and channel configurations, Voltera D and D M ALCs help simplify design, deployment, and long-term system management. Both series can be configured in Tesira or VenueTune, giving system designers the flexibility to match the workflow, control requirements, and audio network protocols of the project.

- Key features of Voltera D and D M ALCs include:**
 - Flexible system design: Supports networked audio, onboard processing, and software-based configuration for scalable venue systems.
 - Advanced DSP options: Voltera D provides integrated loudspeaker management, while Voltera D M adds open-architecture DSP for full Tesira-based processing and distribution.
 - Redundant network audio: Supports resilient network configurations, including Redundant Dante, to help maintain reliable audio performance in mission-critical venues.
- Analog failover and power resilience: Supports failover-to-analog operation, with processor power sustained via PoE to help avoid reboots when main power is interrupted.
 - Group-controlled raised cosine EQ: Provides precise system tuning, room-mode mitigation, and low-frequency optimization across large, distributed systems.
 - High power and channel density: Delivers substantial amplifier output in a compact 1 RU enclosure, with power sharing that can provide up to 75% of total amplifier power through any single channel.
- Load flexibility: Each channel can drive low-impedance, 70V, or 100V loudspeaker loads, making it easier to support hybrid systems from a single platform.
 - Streamlined commissioning: The ALAMOS loudspeaker profile library simplifies setup by providing optimized loudspeaker profiles for hundreds of Biamp loudspeaker models.
 - Compact, efficient design: High power density, low idle power, and reduced device count help save rack space, simplify installation, and lower overall system complexity.

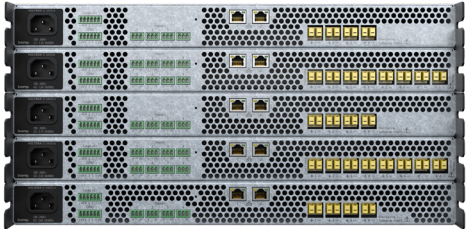
VenueTune

VenueTune software offers in-depth control through an intuitive graphical interface, guiding system designers and installers with simple 2D floorplans and a staged workflow. This software also provides extensive performance and usage logging over time, enabling IT personnel, AV pros, and venue managers to optimize performance after installation.



Tesira

Tesira software provides a robust design and configuration environment for creating highly customized audio systems. Ideal for experienced users and complex installations, Tesira enables detailed control over signal flow, DSP processing, routing, networking, and system logic across a wide range of connected devices. For projects that require advanced customization, integrated control, or coordination across multiple rooms and zones, Tesira gives system designers the flexibility to build sophisticated systems tailored to the exact needs of the venue.



APPRIMO TEC-X TOUCH CONTROLLER

To simplify press box control, Biamp recommends TEC-X controllers for intuitive, localized operation of key system functions. TEC-X controllers provide customizable touch-based control for source selection, level adjustment, mute control, preset recall, and other common functions within a Tesira system, giving operators easy access to the controls they need without exposing the full system configuration.

Available in multiple models, including TEC-X 1000 with a customizable touch panel and rotary knob and TEC-X 2000 with a larger customizable touch panel, TEC-X controllers can be tailored to the needs of each venue or operator position. Multiple pages can be configured to organize controls by source, zone, event type, or operating mode, making it easy to manage game-day audio, announcements, media playback, and other press box functions from a clean, purpose-built interface.

TEC-X controllers connect to the Tesira control network using standard Ethernet and are powered via PoE, simplifying installation and reducing wiring requirements. Because TEC-X control functions are configured directly in Tesira software, they can be integrated into the broader system design without adding unnecessary control complexity.



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